DOCUMENT RESUME

ED 077 768 SE 016 405

TITLE	Innovative Mathematics.
INSTITUTION	Siskiyou County Superintendent of Schools, Yreka, Calif.
SPONS AGENCY	Bureau of Elementary and Secondary Education (DHEW/OE), Washington, D.C.
PUB DATE	Oct 71
NOTE	43p.
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	Curriculum; *Elementary School Mathematics; Inservice Teacher Education; *Instruction; *Low Achievers; Program Descriptions; *Remedial Mathematics; *Research; Teacher Education
IDENTIFIERS	ESEA Title III

ABSTRACT

The purpose of this project was to raise the mathematics skills of 100 mathematically retarded students in grades one through eight by one year through the development of an inservice strategy prepared by four teacher specialists. Also used in the study was a control group of 100 students chosen from the median range of stanines on pretest scores and from the same classes as the experimental groups. The Stanford Achievement Test for grades two through eight and the Wide Range Achievement Test for grade one were used as pretests and posttests. The four teacher specialists worked with 16 cooperating teachers who had in their classrooms students identified as mathematically retarded; a variety of teaching methods and media were identified and implemented with the students in the experimental group. Results indicated that while the control group showed an average gain in achievement of 1.0 on the tests, the experimental group showed an average gain of 1.3. This work was prepared under an ESEA Title III contract. (DT)

FILMED FROM BEST AVAILABLE COPY

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

ED 077768

E. S. E. A.

TITLE 3

RECEIVED
APR 17 1972
ESEA, Title III

Innovative Mathematics

PROJECT No. 318

SISKIYOU COUNTY SUPERINTENDENT OF SCHOOLS

SE016 405

ED 077765

ESEA TITLE III

MATHEMATICS PROJECT

1970 - 71

47-00000-12-0318

SISKIYOU CO. SUPT. OF SCHOOLS

YREKA, CA.

Beginning Date: 7-1-70
Ending Date: 6-30-71

CLARK O'DELL
Assoc. Supt.
Ed. Services
Oct., 1971

This project represents a unique approach to mathematics instruction in rural areas. It is the result of the efforts of both County Office personnel and classroom teachers working together to assist children.

Since this project was a competitively funded activity, evaluation data is extremely important. This information has been thoroughly reviewed and test data compared through the use of computer facilities. Results are most satisfactory and indicate the effect of good educational practice, even under experimental circumstances.

Educators involved in this activity are to be congratulated.

PAUL FISHER
County Superintendent

TABLE OF CONTENTS

TARGET POPULATION	Page 1
EVALUATION STRATEGY	Page 3
PROJECT OBJECTIVE	Page 5
COST/EFFECTIVE EVALUATION	Page 6
CHARTS	Page 19

APPENDICES

PROJECT

TARGET POPULATION

The control group was made up of 100 students chosen from the median range of stanines on pre-test scores. They were chosen from the same classes as the experimental group, and the same number of students was chosen from each grade level as there were experimental students.

The greatest difference between the groups chosen as experimental and control was that the control group, although not all high achievers, were those who might normally be expected to make the advance of one year without special help; whereas the experimental group were those who would not normally have done so.

In most of the project-oriented classrooms, the experimental group received special attention, and the control group received only the attention which was afforded the class under ordinary circumstances.

During finalization of the project, the experimental and control groups, of 100 students each, were rank-ordered and an average taken of the gain made. The control group showed an average gain of 1.0, and the experimental group showed an average gain of 1.3.

The material (people) crossed out with felt pen are those who were eliminated to bring the two groups down to 100 members each.

NARRATIVE

TERMINAL PERFORMANCE OBJECTIVE

To raise the mathematics skills of 100 mathematically retarded students in grades one through eight by one year through the development of an in-service strategy prepared by four teacher specialists (program managers) employed in four elementary school district in Siskiyou County.

The four teachers worked with sixteen "Cooperating Teachers" who were under regular contract to other school districts in Siskiyou County and in addition had in their classrooms students who were identified as mathematically retarded. The program was started because the majority of county educators felt the need of a remedial mathematical program, and there were no county funds to hire specialists. Siskiyou County is one of the most northern California counties and is served from a central county office.

Specialists were chosen from four representative districts. The choice of the teacher specialist was left to the Superintendent of each participating school district.

There were no mathematic specialists on the team.

The choice of cooperating teachers was made from a list of innovative teachers. These teachers were asked if they were interested in taking part in such a remedial mathematics program.

Originally no team specialist was to have a cooperating teacher within his own school. However, when an original team specialist resigned for personal reasons and another was appointed in his place, one cooperating teacher was in his school. As the cooperating teachers were on several grade levels, division of teacher teams was made generally on primary, intermediate and upper grade groupings.

After careful selection by the team specialists, the Stanford Achievement Test was chosen for grades two through eight, and the Wide Range Achievement Test was administered to first grade participants. Test dates were the last week in November, 1970, and the last week in May, 1971.

VISITS MADE BY TEAM SPECIALISTS TO COOPERATING TEACHERS

Alan Stewart	Three times to two teachers and four trips to Weed and Fort Jones, the fourth trip to pick up test materials.
Tom Rose	Four visits to each cooperating teacher.
Glen Minuth	Three visits to each cooperating teacher.
Dorothy Sosey	Four visits to each cooperating teacher.

Inclement weather postponed a number of trips.

TEACHER ASSESSMENT OF PROJECT

STRENGTHS

1. The greatest strength of this project was the total compatability of the group.
2. The informal structure of the program.
3. While four people were responsible to see that the needs and wants of a group of cooperating teachers were met, there were no bosses, consultants or supervisors of the program.

WEAKNESSES

1. Lack of concrete knowledge by participants as to the necessary procedures and the structure of the project.
2. Lateness of testing materials.
3. Late arrival of purchased materials.
4. Communication lack at first meeting.
5. Lack of small group meetings.

4. A small group was concerned with importance of one prime need.

5. Funds were available for materials and services.

6. No judgments were made by anyone other than those made by the individual teacher of himself.

7. Interplay of ideas at meetings.

8. Getting to know other teachers who have the same goal and objective.

9. The vitalized feeling from teaching this year.

10. Student-centered program; not teacher centered.

11. There was a specific objective.

12. Meetings were held during school time; not on teacher's personal time.

6. We question the validity and reliability of standardized group testing.

RECOMMENDATIONS

1. Have demonstrations of materials which could be purchased at an earlier meeting.

2. Have more general meetings.

3. Have more meetings of teacher specialists and the four cooperating teachers in each group.

4. More personal presentations by team specialists and cooperating teachers.

5. Have funds available to make visits among cooperating teachers to each other's schools.

EVALUATION STRATEGY

In developing the strategy for the evaluation of the project, the proposal was reviewed to determine those functions which were critical to the achievement of the mission objective. The evaluation of the management structure of this project is concerned with answers to the following basic question:

A. Was the function (activity) carried out according to plan?

B. Were the support requirements for this function met? (Did materials, supplies, equipment, expertise, etc., arrive on time in appropriate quality and required quantity?)

C. Was the pre-implementation planning for this function adequate? (Was the function over-planned or under planned?)

D. Did the function occur on time according to the specifications set forth in the Functional Time Line Loading Diagram?

E. What specia! problems were encountered in the accomplishment of this function.

In attempting to obtain the answers to the above questions, the evaluator arranged to examine project materials, records and conduct interviews with project personnel. Following the determination of the degree to which each individual function was accomplished, the evaluator assigned a percentage figure which represents degree of effectiveness of the management of that function. A mean of the sub-function percentages is derived, which represents the percentage figure of the Mission Profile function.

A mean percentage of all Mission Profile functions then becomes the percentage effectiveness for the management of the total project. Attached to the total dollar figure expended for the project, the management percentage can be interpreted to represent the cost for "X" percentage of accomplishment of what was proposed: the Mission Objective.

The Cost Benefit in this case can be represented by the cost of development of those matrices which are the result of the project.

A. Was the function (activity) carried out according to Plan?
B. Were the support requirements for this function met? (Did materials, supplies, equipment, expertise, etc., arrive on time, in appropriate quality and required quantity?)
C. Was the pre-implementation planning for this function adequate? (Was the function over-planned or under-planned?)
D. Did the function occur on time according to the specifications set forth in the Functional Time Line Loading Diagram?
E. What special problems were encountered in the accomplishment of this function?

PROJECT OBJECTIVE

To raise the mathematics skills of 100 mathematically retarded students in grades 1 through 8 by one year through the development of an in-service strategy prepared by four teacher specialists (program managers) employed in four elementary school districts in Siskiyou County.

COST/EFFECTIVE EVALUATION

PROJECT MANAGEMENT EFFECTIVENESS FACTOR 95.6 PERCENT

Functional
Management
Effectiveness

100

Function: 1.0 Identify mathematical deficiencies of children in grades 1-8.

Activity: 1.1 Identify math deficiency skills from standardized tests in grades 1-8.

A. The Wide Range Achievement Test was used to identify deficiency skills in the first grade. The Stanford Achievement Test was used for children in the second through eighth grades. Tests were given to approximately 313 children. Skills identified were the actual computational skills and the application of mathematical principles. These deficiencies held through the entire spectrum of the population.

B. Support requirements were reported as being met.

C. Planning for this function was adequate.

D. The testing was completed in the last week in November.

E. The Houghton Mifflin series are the standard texts being used in the target schools, beginning in the primary level through the sixth grade. The Stanford Achievement Test does not seem to be compatible with the text series in some areas, with the exception of computations. This was not realized at the time of test selection.

A. Was the function (activity) carried out according to Plan?
B. Were the support requirements for this function met? (Did materials, supplies, equipment, expertise, etc., arrive on time, in appropriate quality and required quantity?)
C. Was the pre-implementation planning for this function adequate? (Was the function over-planned or under-planned?)
D. Did the function occur on time according to the specifications set forth in the Functional Time Line Loading Diagram?
E. What special problems were encountered in the accomplishment of this function?

Activity: 1.2 Identify math deficiency skills as observed by teachers of grades 1-8.

A. Sixteen elementary teachers listed mathematical skill deficiencies. These skill deficiencies are considered as being basic to all operations.

B. None required.

C. Planning was adequate.

D. Accomplished on time.

E. No special problems were encountered.

Activity: 1.3 Compile list of math deficiencies identified in grades 1-8.

A. A list of math deficiency skills which incorporated 1.1 and 1.2 was developed.

B. None required.

C. Planning was adequate.

D. On time.

E. No special problems were encountered.

75

Function: 2.0 Determine mathematical deficiencies to be alleviated.

Activity: 2.1 Identify required knowledge/skills needed by children to eliminate math deficiencies on a continuum by grades.

A. The knowledge and skills requirements were detailed and the level of computation and application of principles at each grade level was specified. This was accomplished by the sixteen cooperating teachers.

A. Was the function (activity) carried out according to Plan?
B. Were the support requirements for this function met? (Did materials, supplies, equipment, expertise, etc., arrive on time, in appropriate quality and required quantity?)
C. Was the pre-implementation planning for this function adequate? (Was the function over-planned or under-planned?)
D. Did the function occur on time according to the specifications set forth in the Functional Time Line Loading Diagram?
E. What special problems were encountered in the accomplishment of this function?

B. None required.

C. Planning was adequate.

D. This function (activity) was actually accomplished early in the project. It should be noted that the pre-implementation planning called for this to be accomplished earlier than was actually possible. In terms of planning, this activity was deemed critical to the in-service and instructional phases of the project. Planning did not, however, take into account the tooling-up time required. Management has not, therefore, been penalized.

E. No special problems encountered.

Activity 2.2 Rank order children's most critical skills needs.

A. It was management's decision to bypass this function.

Activity 2.3 Secure consensus of most critical skill needs.

A. Since the skills were not ranked, this function was not necessary. The concurrence of consensus for the identified skills requirements was obtained primarily because the group as a whole made the identification.

B. None required.

C. See note under "D," activity 2.1

D. Not applicable

E. No special problems encountered.

A. Was the function (activity) carried out according to plan?
B. Were the support requirements for this function met? (Did materials, supplies, equipment, expertise, etc., arrive on time, in appropriate quality and required quantity?)
C. Was the pre-implementation planning for this function adequate? (Was the function over-planned or under-planned?)
D. Did the function occur on time according to the specifications set forth in the Functional Time Line Loading Diagram?
E. What special problems were encountered in the accomplishment of this function?

Function: 3.0 Identify required teaching knowledge/skills to alleviate mathematical deficiencies.

Activity: 3.1 Identify necessary k/s of teachers at each grade level.

A. Each participating teacher was asked to evaluate his own strengths and weaknesses in terms of the teaching of mathematics at his or her particular grade level assignment. NOTE: Function 4.0 called for the identification and securing of commitment of teachers to participate. This function was actually carried out prior to the assessment of teacher k/s requirements. Those teachers who had been selected for participation in the project determined for themselves what the knowledge and skills requirements were. It is not for the evaluator to say at this point in time that this is a good or bad technique. It is only for the evaluator to point out that to the exact letter of the proposal, the functions were not carried out as proposed. It should also be noted that according to the current thinking of the U.S.O.E. Title III, E.S.E.A. personnel, it is not necessary to conduct a project in strict accordance with the proposal. The functions can be changed at the discretion of project management. This opinion was expressed by representatives of the U.S.O.E. at the July workshop conducted by the U.S.O.E. in San Francisco, California

B. Working space and reference works were supplied in appropriate quantity and quality for this function.

C. Insofar as management decisions are concerned, this function was accomplished on time.

Activity: 3.2 Produce list of necessary k/s teachers will be required to have.

A. This function was not carried out in a formal fashion. As was pointed out in Function 3.1, each teacher made his own assessment.

A. Was the function (activity) carried out according to plan?
B. Were the support requirements for this function met? (Did materials, supplies, equipment, expertise, etc., arrive on time, in appropriate quality and required quantity?)
C. Was the pre-implementation planning for this function adequate? (Was the function over-planned or under-planned?)
D. Did the function occur on time according to the specifications set forth in the Functional Time Line Loading Diagram?
E. What special problems were encountered in the accomplishment of this function?

B. C. D and E are not applicable.

100

Function: 4.0 Identify and secure teacher commitments to participate.

Activity: 4.1 Identify teachers of children who have mathematical skills deficiencies.

A. From an initial list of 26 teachers in Siskiyou County, 16 were identified as possible participants in the program.

B. All required information about classroom teachers and student performance was supplied by the districts and county office.

C. Planning was adequate.

D. Function took place on time according to management decisions.

E. No special problems were encountered.

Activity: 4.2 Identify school districts of these teachers.

A. Fifteen school districts in Siskiyou County were represented in the project.

B. District and county offices supplied the required support.

C. Planning was adequate.

D. Function proceeded on time.

E. No special problems were encountered.

A. Was the function (activity) carried out according to plan?
B. Were the support requirements for this function met? (Did materials, supplies, equipment, expertise, etc., arrive on time, in appropriate quality and required quantity?)
C. Was the pre-implementation planning for this function adequate? (Was the function over-planned or under-planned.)
D. Did the function occur on time according to the specifications set forth in the Functional Time Line Loading Diagram?
E. What special problems were encountered in the accomplishment of this function?

Activity: 4.3 Secure commitment to cooperate from school districts and teachers.

A. Invitations to participate were extended to 16 teachers in 15 districts. Teachers who declined were substituted by an alternate from the original list as given in 4.1. Three of the initial teachers declined for personal reasons and were replaced by alternates.

B. All support requirements in terms of secretarial effort were met.

C. Planning was adequate.

D. Function proceeded on time.

E. No special problems were encountered.

100

Function: 5.0 Design the teacher knowledge/skills program.

Activity: 5.1, 5.2 and 5.3. Determine the required method/media; determine the required training site(s); and develop schedule of necessary k/s training activities. NOTE: Because of the manner in which this major function was accomplished, the entire function is detailed here.

A. Eleven meetings were planned for the four teacher specialists who are referred to as "Program Managers." Four group meetings were planned for the 16 cooperating teachers and the four program managers. The training site which was selected was the Shasta Royal Inn at Dunsmuir, California. Four visitations to the classrooms of the cooperating teachers were planned for each of the program managers.

B. In terms of the project management, all support requirements were met.

A. Was the function (activity) carried out according to plan?
B. Were the support requirements for this function met? (Did materials, supplies, equipment, expertise, etc., arrive on time, in appropriate quality and required quantity?)
C. Was the pre-implementation planning for this function adequate? (Was the function over-planned or under-planned?)
D. Did the function occur on time according to the specifications set forth in the Functional Time Line Loading Diagram?
E. What special problems were encountered in the accomplishment of this function?

C. Pre-implementation planning called for the activities to be performed in a specific manner. The evaluator is at this time reporting the conduct of the activities as was determined by on-site visitations.

D. Function was accomplished on time.

E. No special problems were encountered.

100

Function: 6.0 Secure the required method/media

Activity: 6.1 Identify sources of required M/M to be secured or produced.

A. A variety of methods/media which teachers found useful were identified for demonstration to the entire group of participating teachers.

B. None required.

C. Planning was adequate.

D. On time.

E. No special problems encountered.

Activity: 6.2 Teaching materials which were identified and listed under Activity 6.1 were primarily teacher-made materials.

A. Additional materials were provided by two Siskiyou County Office mathematics specialists.

B. County Office personnel supplied the additional teaching materials which were required for the training program.

C. Planning was adequate.

A. Was the function (activity) carried out according to plan?
B. Were the support requirements for this function met? (Did materials, supplies, equipment, expertise, etc., arrive on time, in appropriate quality and required quantity?)
C. Was the pre-implementation planning for this function adequate? (Was the function over-planned or under-planned?)
D. Did the function occur on time according to the specifications set forth in the Functional Time Line Loading Diagram?
E. What special problems were encountered in the accomplishment of this function?

D. On time.

E. No special problems were encountered.

100

Function: 7.0 Secure training sites.

Activity: 7.1 Identify location of training sites; and
7.2 Secure training sites according to activities.

A. Since the Shasta Royal Inn was selected, there was no further requirement to determine the location. Reservations were made for the utilization of the training site according to specifications of time.

B. None required.

C. Planning adequate.

D. On time.

E. No special problems.

90

Function: 8.0 Implement necessary k/s program activities, with target groups (teachers and students).
8.1 Implement scheduled activities with teachers.

A. February 26th was the time cooperating teachers demonstrated their individual choices in the utilization of teaching materials in mathematics. This meeting was held in Dunsmuir. March 23rd the two County Mathematics Specialists demonstrated their choices of additional methods/media to the cooperating teachers. These demonstrations constituted the teacher training program.

A. Was the function (activity) carried out according to plan?
B. Were the support requirements for this function met? (Did materials, supplies, equipment, expertise, etc., arrive on time, in appropriate quality and required quantity?)
C. Was the pre-implementation planning for this function adequate? (Was the function over-planned or under-planned?)
D. Did the function occur on time according to the specifications set forth in the Functional Time Line Loading Diagram?
E. What special problems were encountered in the accomplishment of this function?

B. All training materials were on site at the required time.

C. Planning called for this function to be performed in the manner stated in the proposal.

D. According to management design, the function occurred on schedule.

E. No special problems were encountered.

Activity: 8.2 Implement required activities with children.

A. Materials for utilization as methods/media for mathematical skill deficiency alleviation arrived primarily during the month of January. This training with children, utilizing the above materials, was conducted through the month of May.

B. Practically all the materials used in this phase of the project were of the teacher-made variety. It should be noted that of the entire array of materials available and demonstrated, approximately 90% of the ready made teacher materials arrived at the 15 school district sites sometime in May. This was too late for use in the program this year. All teacher-made materials were produced and were distributed throughout the project. Any results obtained in terms of student achievement should be appropriately attributed to the utilization of teacher-made materials and the interchange of ideas and media usage as a result of the training program for teachers.

C. Planning was adequate for this function.

D. With the exception of ready-made materials usage, the function took place on time.

A. Was the function (activity) carried out according to plan?
B. Were the support requirements for this function met? (Did materials, supplies, equipment, expertise, etc., arrive on time, in appropriate quality and required quantity?)
C. Was the pre-implementation planning for this function adequate? (Was the function over-planned or under-planned?)
D. Did the function occur on time according to the specifications set forth in the Functional Time Line Loading Diagram?
E. What special problems were encountered in the accomplishment of this function?

E. Test materials were ordered, but the test producers forwarded the wrong tests. These had to be re-ordered. This caused a delay in the testing program, which further delayed the total implementation. It is suggested that more time be given between ordering, receipt of and utilization of this kind of ready-made product.

Function: 9.0 Evaluate teacher k/s in-service program, post-test.

Teacher upgrading of knowledge and skills in the teaching of mathematics using a variety of methods-media was accomplished by means of informal dialogue and exchange of ideas. Assessment of the degree of upgrading of proficiencies was accomplished by means of individual teacher self evaluation. Each cooperating teacher was asked to evaluate his or her experience and knowledge at the end of the program as compared with the beginning of the program. See appendix for individual teacher evaluation.

COST/BENEFIT EVALUATION

OBJECTIVE

To raise the mathematics skill of one hundred mathematically retarded students in grades one through eight by one year.

SELECTION OF SUBJECTS

1. All students in grades two through eight were administered the Stanford Achievement Test.

2. Students in the first grade were administered the Wide Range Achievement Test.

3. The control group was composed of 100 students selected from the median range of stanines on the pre-test scores.

4. The experimental group was composed of 100 students selected from below the third stanine on the pre-test scores.

RESULTS

To determine if the innovative methods of mathematics instruction attained the objective desires, all control and all experimental students were given the same pre-test as the post-test. Chart "A" indicates the number of students in each group and the average gain for each group.

To determine if there was any significance to this gain, computations were made to determine the significance between the uncorrelated means for each group. The mean average gain for the control group was found

to be .89 and for the experimental group was found to be 1.22. The standard deviation was computed for each group. The standard error of the mean for each group was computed and the standard error of the difference of the mean was determined. Critical ratio was determined by dividing the difference of the two means by the standard error of the difference of the means. For the entire group this was computed and was found to be .471, which is significant at the .01 level of significance.

This same procedure was performed on each of the grade levels represented in the study. The results of the computation appear in Chart "B." It should be noted that three students in each of the groups in the first grade and five students in each of the groups in the second grade are not sufficient numbers to use for reliable statistics. All of grade three was dropped due to a change in class distribution, which prevented a large portion of each group from participating.

The results indicated that the difference of average gain between the experimental group and control group for grades 4, 5 and 8 was significant at the .01 level, and the average gain for grade 7 was significant at the .05 level. Although the difference in average gain for grade 6 was not significant, the experimental group gained 1.03 grade levels compared to .98 grade levels for the control group. The range of average gain for students in the experimental phase of the program was from 1.03 to 1.48 average gain. The range of average gain for students in the control phase of the program was from .44 to 1.38.

A comparison was made of the gains during this year of treatment for the mathematically retarded with their previous annual gain. The previous annual average mean gain was computed by dividing the difference of the pre-test score and the grade level of the student by the number of years he had been in school. Previous annual average mean gains were computed for each grade level. The difference in these previous average mean gains and the average mean gains during this year of treatment were noted for both the experimental and control groups and can be found in Chart "C," which follows. The first, second and third grades were not computed due to insufficient numbers for accurate results.

In the fourth grade, there were 25 students in the experimental (mathematically retarded) group and 25 students in the control group. The previous annual mean gain for the experimental group was .99 years and for the control group was 1.33 years. During this year of treatment, the experimental group had a mean average gain of 1.08 years, while the control group had a mean average gain of .60 years. This represents a .09 year's gain for the mathematically retarded group and a mean loss of -.73 years over the previous annual average mean gain for the control group.

There were 12 students in the mathematically retarded group and 12 students in the control group for the fifth grade. The previous annual average mean gain for the experimental group was 1.0 years, and for the control group was 1.24 years. During this year of treatment, the experimental group had a mean average gain of 1.35 years, while the control group had a mean average

gain of 1.12 years. This represents a .35 year gain for the mathematically retarded and a mean loss of -.12 years over the previous annual average mean gain for the control group.

In the sixth grade there were 17 students in the mathematically retarded group and 17 students in the control group. The previous annual average mean gain for the experimental group was .97 years and for the control group was 1.31 years. During this year of treatment, the experimental group had a mean average gain of 1.03 years, while the control group had an average mean gain of .98 years. This represents a .06 year gain for the mathematically retarded and a mean loss of -.33 years over the previous annual gain for the control group.

There were 20 students in the mathematically retarded group and 20 students in the control group for the seventh grade. The previous annual average mean gain for the experimental group was .86 years and for the control group was 1.05 years. During this year of treatment, the experimental group had a mean average gain of 1.48, while the control group had a mean average gain of 1.31. This represents a .62 gain for the experimental group and a .26 gain for the control group over the previous annual gain.

In the eighth grade there were 18 students in the mathematically retarded group and 18 students in the control group. The previous annual average mean gain for the experimental group was .81 years and for the control group was .99 years. During this year of treatment, the experimental group had a mean average gain of 1.38 years, while the control group had a mean average gain of .62 years. This represents a .57 year gain for the mathematically retarded and a mean loss of -.37 years over the previous annual gain for the control group.

In summary, over a five-year grade span, 4-8, the mathematically retarded students, after receiving the treatment of this program, gained 6.32 years of mathematical skill, while during this same time the same five-year grade span, 4-8, the control group gained 4.63 years of mathematical skill.

Reviewing the percentages of students who made gains in the experimental group, 67% of these students gained 1.0 grades or more; 21% gained from .5 to 1.0 grades or more; and 12% gained from .3 to .5 grades or more. It should be noted that no students in the experimental group went backward in their mathematical achievement average. In comparison, 50% of the students in the control group gained 1.0 grades or more; 24% gained from .5 to 1.0 grades or more; 16% gained from .0 to .5 grades or more; and 10% lost in their mathematical achievement average.

CHARTS

CHART "A"
COMPARISON OF PERCENTAGE OF STUDENTS
BY AVERAGE GAIN IN MATHEMATICAL ACHIEVEMENT

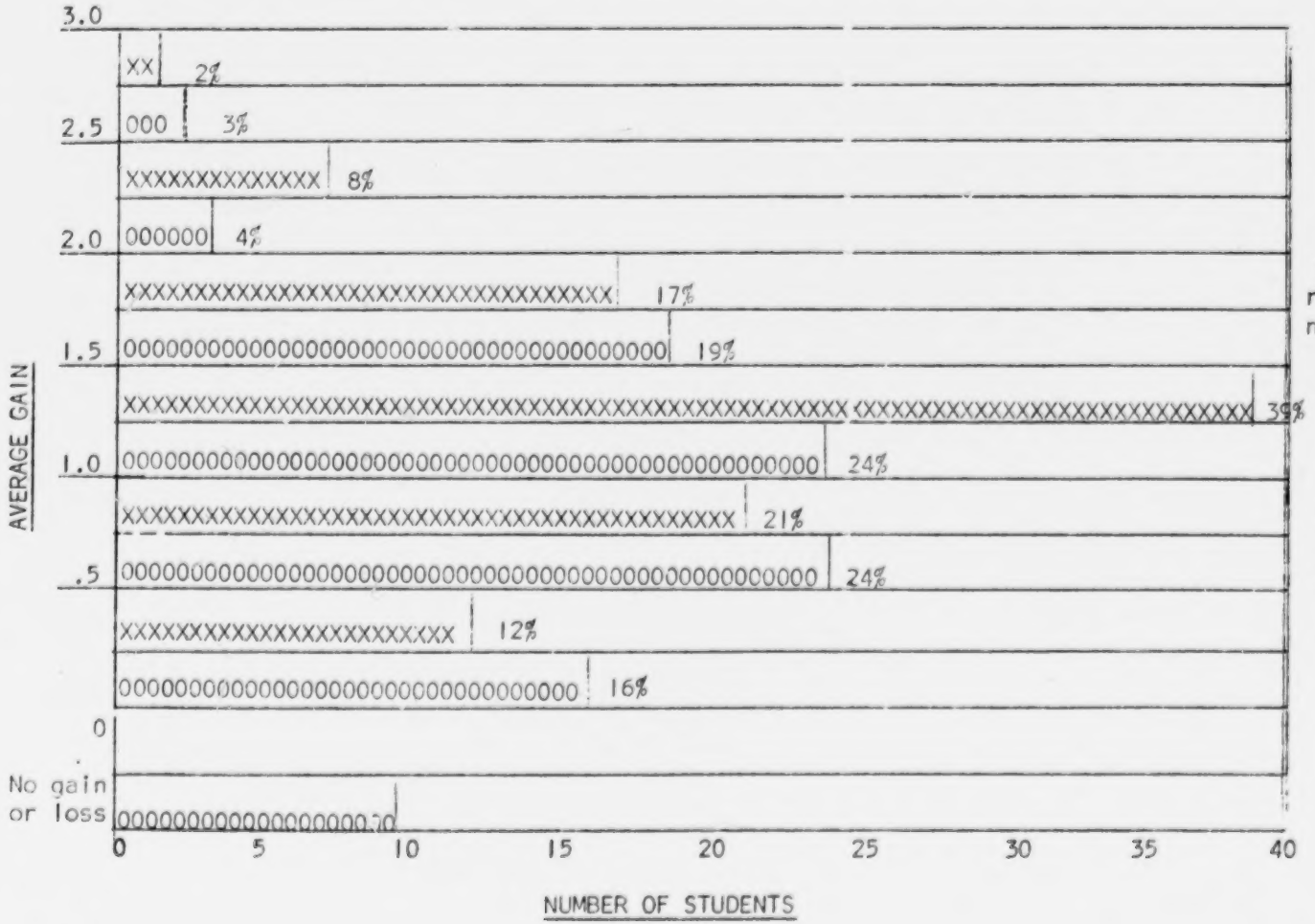

3.0
2.5
2.0
1.5
1.0
.5
0
No gain or loss
AVERAGE GAIN
XX 2%
000 3%
XXXXXXXXXXXXX 8%
000000 4%
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 17%
0000000000000000000000000000000000000 19%
XXXXXXXXXXXXXXXXXXXX

CHART "B"

		Number of Subjects	Mean Gain	Standard Deviation	SD of Mean	Diff. of Mean	SD of Diff. of Mean	Critical Ratio	(Null tables) .05 level	(Null tables) .01 level	Level of Significance
1st Grade	Exp.	3	1.56	1.46	.84	.76	1.0	.76	.811	.917	NOT
	Con.	3	.80	.99	.57						
2nd Grade	Exp.	5	1.1	1.14	.50	-.54	.90	-.60	.632	.765	NOT
	Con.	5	1.64	1.66	.74						
3rd Grade	Exp.	0	All 3rd grade dropped as a change in class distribution removed students from participating in this program.								
	Con.	0									
4th Grade	Exp.	25	1.08	1.16	.23	.64	.08	.80	.274	.355	.01
	Con.	25	.44	.60	.12						
5th Grade	Exp.	12	1.22	1.35	.39	.43	.50	.86	.404	.515	.01
	Con.	12	.79	1.12	.32						
6th Grade	Exp.	17	1.03	1.17	.28	.05	.40	.125	.326	.419	NOT
	Con.	17	.98	1.22	.29						
7th Grade	Exp.	20	1.48	1.62	.36	.17	.50	.34	.308	.397	.05
	Con.	20	1.31	1.59	.35						
8th Grade	Exp.	18	1.38	1.53	.36	.76	.43	1.76	.325	.418	.01
	Con.	18	.62	1.12	.26						
Entire Group		100	1.22	5.93	.59	.33	.70	.471	.138	.181	.01
		100	.89	3.73	.37						

CHART "C"

COMPARISON OF PREVIOUS ANNUAL GAIN
TO GAIN MADE DURING YEAR OF TREATMENT

GRADE LEVELS	4th		5th		6th		7th		8th	
EXPERIMENTAL OR CONTROL	Exp.	Cont.	Exp.	Cont.	Exp.	Cont.	Exp.	Cont.	Exp.	Cont.
NUMBER OF STUDENTS	25	25	12	12	17	17	20	20	18	18
PREVIOUS MEAN GAIN PER YEAR	.99	1.33	1.00	1.24	.97	1.31	.86	1.05	.81	.99
RANGE OF GAIN IN PREVIOUS YEARS	- .8 +1.8	- .4 +1.6	-1.0 +-.8	- .7 +1.2	-1.0 +1.7	- .9 +3.9	-1.9 +2.1	- .2 +1.9	-3.3 + .1	-1.18 + .9
MEAN GAIN DURING PROGRAM	1.08	.60	1.35	1.12	1.03	.98	1.48	1.31	1.38	.62
MEAN DIFFERENCE OF GAIN	.09	-.73	.35	-.12	.06	-.33	.62	.26	.57	-.37
AVERAGE GAIN FOR YEAR	.09		.35		.06		.62	.26	.57	
AVERAGE LOSS FOR YEAR		-.73		-.12		-.33				-.37

APPENDICES

APPENDIX A

EVALUATION OF MATERIALS USED IN TITLE III MATH PROJECT

MATERIAL	SOURCE	APPROXIMATE GRADE LEVEL	SKILL	EVALUATION Excel.	Good	Poor
Pyramid (Tower Puzzle)	Creative Publications	K-8	Abstract Thinking		X	
Musical Multiplication Record	Bremner Corp.	3-6	Multiplication facts	X		
Wonderful Record of Facts	A. Caddy Co.	1-3/4 - 8	+-x÷	X		
Color Rods	Houghton Mifflin	1-3	Addition and Subtraction	X		
Color & Puzzle	Creative Publications	3-7	Visual perception; Identifying geometric shapes		X	
Krypto	Creative Publications	4-8	Number facts	X		
Heads Up	Creative Publications	4-8	Basic equations	X		
Quiet Counters		1-3	Addition and Subtraction facts	X		
Pic-A-Puzzle	Creative Publications	K-8	Geometric design	X		
Bingo	Creative Publications	1-6	Number recognition	X		

Appendix "A" (Cont'd.)

MATERIAL	SOURCE	APPROXIMATE GRADE LEVEL	SKILL	EVALUATION Excel.	Good	Poor
Noisey Numbers						
Duplicating Masters						
Bali Buttons	Creative Publications	3-8	Logic		X	
3 Dimensional Tic-Tac-Toe	Creative Publications	3-8	Logic	X		
Diagnostic tests to accompany Modern School Math	Houghton Mifflin	1-8	Testing	X		
Balance Beam	H. Smith	1-2	Addition and Subtraction			X
Deaf & Dumb	E. Jones	1-6	Number combinations		X	
Math Rummy	E. Jones	3-6	Combinations	X		
Twenty Is Plenty	County	1-4	Logic		X	
Egg Carton Checkers	County	3-8	Logic	X		
Arithmetic Bingo	E. Jones	3-8	Multiplication Facts	X		
Yahtze		4-8	Logic and Computation		X	

Appendix "A" (Cont'd)

MATERIAL	SOURCE	APPROXIMATE GRADE LEVEL	SKILL	EVALUATION Excel.	Good	Poor
Grid Paper	Houghton Mifflin	1-8	Graphs and Math facts	X		
Geo Braces	Houghton Mifflin	1-8	Geometric shapes; Creative shapes	X		
Open End Abacus	Houghton Mifflin	1-8	Place Value	X		
Geometric Shapes	Houghton Mifflin	1-8	Understanding shapes and seeing shapes	X		
Programmed Math	Sullivan Assoc.	4-8		X		
Program Practice	Houghton Mifflin	1-8	Reinforcement	X		
X and O Games	A. Preece	1-2	Addition facts	X		
1, 2, 3 Bears	A. Preece	1	Addition facts		X	
Work Sheet	A. Preece	1-2	Addition and Subtraction facts	X		
Teaching Machine With Math Rolls	O. Gribkoff	5-6	Multiplication, Division and Fractions	X		
Trick Problem	O. Gribkoff	5-8	Problem Solving		X	
Building A House	O. Gribkoff	7-8	Problem Solving (Measurement Geometry)		X	

Appendix "A" (Cont'd.)

MATERIAL	SOURCE	APPROXIMATE GRADE LEVEL	SKILL	EVALUATION Excel.	Good	Poor
Recipes	O. Gribkoff	5-8	Fractions		X	
Field Day	O. Gribkoff	6-8 (Work in with 6th grade P. E. Tests)	Problem Solving	X		
Self Proving Practice	O. Gribkoff	4-6	Multiplication and Division	X		
Napier's Rods	O. Gribkoff	5-7	Multiplication		X	
Division Practice	O. Gribkoff	5-6	Division		X	
Multiplication Game	O. Gribkoff	4-5	Recognizing Multiplication	X		
Circle Game	O. Gribkoff	5-8	Multiplication and Division	X		
Building an Abacus	O. Gribkoff	7-8	Understanding other Numeration systems		X	

APPENDIX "B"

COOPERATING TEACHERS' EVALUATIONS

1. MAXINE HURLEY:

"I started as a member of the group unsure of myself with regard to the new textbook and its different approach to the subject. I had hoped to become better acquainted with the materials already available by this, and other, companies that would complement the textbook and its approach.

"The most valuable meeting was the presentation by the two Math Specialists from the County Office. It would have been more help if their ideas and materials had been presented earlier in the year.

"The ideas and materials presented by the group (and myself included) were nothing very new but old "tried-and-true" helps. They were all excellent, however, and will be of great value to new and inexperienced teachers.

"I did not receive the help I needed and was looking for, nor did I contribute as much as I should, or could, have. I feel that if this group could function again next year we could all do a better job. We should now know our material and how our students "might" respond to it. We shoud know now and have a better idea of our areas of difficulty and the necessary special projects on which to work.

"I would like to be able to see the last test scores to see how my students muddled through my uncertain year.

"Materials used:

1. Transparancies for Overhead Projector:

   These number wheels were used for drill - all four operations may be used at any grade level. Instead of overhead transparancies a wheel may be drawn on the chalkboard each time.

2. Speed Tests (4):

   I realize that speed tests for addition, subtraction and multiplication are old fasioned and that students learn when there is a need. They are also aided to discover how to figure out multiplication number facts. However, I subscribe to the theory that there is a need for mental discipline. What better way? Along with the learning of these number facts, we should make it fun, interesting and provide rewards.

3. Flannel Board Set for Fractions:

   Using 9x9" felt squares, I cut pieces into fractional parts using different colors: halves - blue; thirds - yellow.

1.

4. Flannel Board Set for Study of Sets:

Felt cutouts of various designs were made to show sets: equal, equivalent, union, intersection. Yarn was used for set "boundaries" and holds nicely on flannel board. These were made from scraps but may be purchased from Geography Workbook Co.

NOTE: Fourth graders are not too old to still be interested in flannel boards. It always helps to present an idea with a different visual aid. Anything but the "same old thing." I save my flannel board for these two areas of study so it will not become "old hat."

5. Student Workbook:

I had a teacher's copy only and by means of a Thermofax copied only the pages needed. I used approximately 15 pages. Each page covered only one concept.

6. Duplicating Masters:

These were used as a review and/or survey test. Each page covered two or three concepts presented. I used it mainly to test myself to see areas where I needed to re-teach.

7. Geometric Shapes:

This was a small set and was fine for personal use and identification but didn't serve the purpose I wanted. Larger shapes would be more desirable. Students weren't too interested after once seeing them. They thought they were pretty and not much more!

8. Math Bingo:

These sets were received the last week of school, and I was unable to evaluate them. They will be used during Summer School. I used regular Bingo sets on rainy days making up my own problems. Instead of saying "B-12" you may call "B- (8+4) or (3x4)." This is a fun way to practice their knowledge. It is also rewarding (one of those needs mentioned) since they all want to be first to yell "BINGO!"

9. Numble:

This also arrived late but looks rather difficult to play.

10. Multifactor:

This was a toy I had at home, and the students enjoyed working with it. There are a series of multiplication number facts printed on top. They guess the answer and can push down on the problem and the answer is revealed. It is good for team practice but not too durable.

11. Quiet Counters:

These were used by Loretta Stockton with slow learners. It would help if they came in different colors to show place value and not have such tall "stacks."

12. Fraction Chart:

This is an old but very good chart that show equivalent fractions. It is 24" x 30" and fold flat for easy storage. Geography Workbook Co. makes it. I believe it costs under $2.00.

"I made up many worksheets that included all four operations, money measurement and story problems. They were not included since they were aimed at areas of difficulty suffered by this one class at one particular time. They would help some and theywould move on and I would look for a new approach for those who needed still more help.

"Many worksheets of story problems were posed by students. Master copies were not kept."

II. JAMES ANDERSON:

"This year I have tried to use a wide variety of games, gimmicks and devices to supplement my mathematics program. Some of them I have received in some way from the Title III project. Others I have either developed myself or have borrowed from some other service.

"At the start of the year I had determined to have my room filled with various manipulative materials. Over the course of the year, I accumulated a wide variety of these aids, mostly commercially produced and several purchased by Title III funds. I always tried to schedule about ten minutes per period of "free" time, during which time assignments could be finished or special aid given. All students were free to use the games during this time.

"By the end of the year I had developed what was, for me, a rather successful testing technique. Three times a week, at the start of the period, we would have a test. This generally consisted of one review problem and one current problem. I found this system far more successful than the more standard weekly test. It seemed to help a number of students who had trouble with large tests, and didn't appear to hurt those who were successful on the large tests.

"Last summer I started collecting books of math puzzles and typing onto 5"x8" cards those which I thought could be handled by my students. I accumulated close to 200 of these verbal puzzles, and one of these was placed on the wall every day, not as an assignment but rather as a challenge. Many of these puzzles were too difficult, but I found that almost all of the students took the time to read them and generally make some attempt to solve them.

"The students loved to become involved in creating puzzles. At the start this was confined mainly to cross-number puzzles. Later they became interested in making mazes. These are rather simple to make but hard to solve. Any mathematical operation can be used in them, but they soon become quite difficult. Basically, they consist of a number of concentric circles, each with between three and five "gates" in them. In these gates numbers were placed. At the top of the puzzle an operation was indicated. The puzzle was to find a path to the center, using the indicated operation.

"From creating puzzles, the students rapidly went on into other areas. I encouraged a certain amount of boy-versus-girl competition. The girls would bring in recipes (some of which were rather creative in themselves) generally listing the ingredients for four servings. They would then challenge the boys to determine the proper amount of each ingredient for, say, 25 servings. It was amazing to me to see the number of girls who couldn't do anything on a fraction worksheet, who could easily handle quite complex fractions in recipes. The boys revenge, generally, consisted of challenging the girls to figure out batting averages and other rather complex things having to do with sports. I ran into trouble there

because I didn't (and still don't) quite understand what ERA means. But then I'm not really too eager to find out.

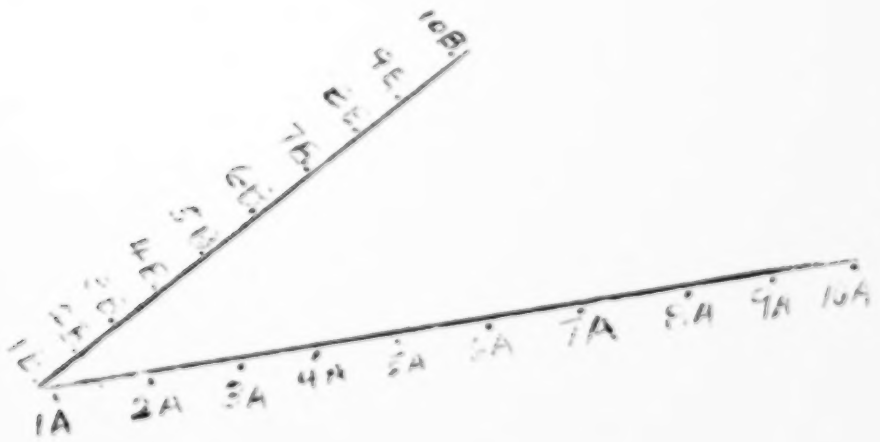
"In these competitions there was always some sort of prize. Around the middle of the term the Title III funds provided me with the best one of all - a game called KRYPTO. The best game (and sneakiest trick) I've seen all year long. All of my students loved it. They never tired of it, and they would do any amount of work to be allowed to play it. If I had tried to force them to work so hard reviewing their arithmetic facts, I'm sure that there would have been a revolution.

"Early in the year, as a class project, one of my classes made geoboards. These were then used for the remainder of the year. I can think of no better way of introducing geometric concepts. I deeply regret that we were not able to meet with Mr. Prestegard earlier in the year. I found his tool quite valuable, but it came much too late in the year. In one of the recent issues of the Arithmetic Teacher there is a section on games on the geoboards. We tried these at the end of the year and found them quite successful. If funds can be found from someplace, I hope to make an animated movie on geometry, using geoboards and rubber bands as the only props.

"I hope that someone will be able to use some of these ideas. They worked well for me this year in both the 7th and 8th grades. This project has been of help to me this year, although I was frequently rather confused about what was going on with it.

1. Sewing Line Designs:

Make design framework onmoderately heavey cardboard. With pins and/or needles, put holes in framework lines. (The two lines to be connected must have the same number of holes, but these holes need not be the same distance apart.



With bright thread, connect the holes in this order:

Tape thread under hole 10-A. Bring up through 10-A, then down through 1-B. Up 2-B, down 9-A. Up 8-A, down 3-B, etc. When finished, this forms very pretty, curved line design. Design varies by varying distance between holes and location of framework lines (these should be drawn on back side so as not to mar display surface). Also works with with circles as framework (or any shape, really).

2. Grocery Store:

Go to some local store with class. Select between 30 and 50 different foods. Record price and weight of all brand names of each food. In class calculate price per unit of weight of all brands. (This ends the first step)

Return to store each month; record prices of one brand (previously selected) of each type of food in first survey. In class, compare prices with all previous monthly prices. Calculate per cent increase in food prices (or decreases, if you want to dream).

In class, determine family food budget for four. Determine food consuming for level at start of year. Over year calculate:

1. Per cent increase in budget to keep standard consumption level.

2. Per cent decrease in consumption level to keep standard budget.

3. Grocery Store Check:

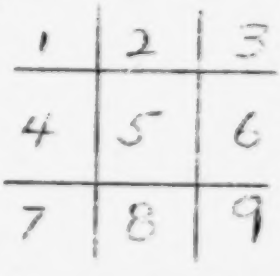
1. Check price per quantity of various competing brands.

2. Time span check on inflation.

3. Make budget.

4. Tic-Tac-Toe (On Board, or in Mind, Only):

Nothing is written by players. Play from memory. Call out numbers. Start with this on board:



Then play in mind only. You must have some non-partisan score keeper to keep track of moves.

III. RALPH PRICKETT:

"Comments on materials, projects and games used:

"I. 'Programmed Practice - Modern School Mathematics, Structure and Use,' by P. O. Redgrave and J. J. Roberge, Houghton Mifflin Co. This workbook was supplied to each of the ten pupils for this program. Every Friday a special meeting was held with the children during the afternoon class activity period to discuss progress in the workbook. My requirement for the children was that theymaintain a page by page assignment current with the regular Houghton Mifflin textbook during the year. This was quite convenient and easy for most of the children due to the structure of the workbook. As you know, the corresponding pages covered in the Houghton Mifflin Textbook are also given in this workbook.

"Some preliminary difficulties were experienced as the children became familiar with the format of the 'Programmed Practice' workbook during the first week. After this period the exercises went fairly easy with no real problems developing. The children were, in fact, getting double coverage (in different ways) of the same material. By school's end in June, all children had completed the required sections of the workbook. I would generally recommend the use of the 'Programmed Practice' as a supplement to the regular Houghton Mifflin classroom text.

"II. Balance Beam - Addition/Subtraction: This mechanical balance used washers and number pegs to illustrate addition and subtraction manipulation. The machine created quite a bit of interest initially but had limited value at the intermediate level. Interest lasted about one week for the 5th and 6th grades and two weeks for the 4th grade. This device probably would be more successful at the primary level.

"III. Multiplication Aids: Since the learning of the multiplication tables is central to further advancement in other areas of math (all but subtraction/addition), I placed some emphasis on accomplishing this task. A contest was started for all four intermediate sections (120 children) with candy rewards in June. Two major aids were used - timed records* with three second, four and one-half second and six second spacing of multiplication facts, and flash cards (round robin) contests. Considerable time was spent indicating the basic need for multiplication in math. Approximately 85% of the sixth grade had mastered perfect scores in all multiplication tests.

"IV. Geoboards: My observations on the use of the geoboards have led to mixed feelings. Some learning was obviously taking place, but also quite a bit of artistic play was involved. Exactly how much math learning occurred, I am not sure at this time."

---

*"The 6 Wonderful Records of Facts."

IV. DOROTHY DELGADO:

"Sorry I am so slow in getting this off to you. I used everything you sent me and all the ideas brought by the others that would apply to fourth grade. I'm sorry that I am not very original. Everything listed was suggested by other people at the meetings. The only games you might not be familiar with were out of the old arithmetic - state series - before the new math.

1. Baseball Game:

We split into teams and use a prepared board. Each child to go around makes a run for his team.

2. Automobile Race:

Split into several teams. Each team chooses a car name. They write the answers to multiplication problems on a paper. They exchange papers and draw circles around incorrect answers. All correct stand up. Everyone in team must stand to earn two points. One point is given for speed (first team to stand when finished writing answers). At the end, add up scores. Car with the most points wins the race.

3. Travel:

One child contests another. Both stand. Whoever answers problem first moves on to contest another child. Whoever travels the most distance wins the game.

"I thought your program was interesting and helpful. I'm sorry that I am not more original."

V. FRANK PAVLIK:

"I honestly used very few materials that I don't normally use. I did try such devices as Tangram, WFF and Logical Blocks. Mose of these aids I think we know too little about and therefore do not realize the full potential of. Maybe, as you are compiling a list of worthwhile aids, it would be wise to describe their usefullness and some hints as how to more effectively use them. I know I didn't, and I doubt whether many teachers can devote the necessary time to learn this on their own.

"I use group tables in my room in school, and I think this is very effective. The children probably teach each other as well as we do. The only drawback is with testing. Children have a hard time concentrating on their own work.

"I think that the best device for holding interest was a problem I made up on a clothing store operation. This included work with fractions, decimals and percents and showed where it might be necessary to learn such things.

"As for the program itself, I think there was far too little communication involved. I was not contacted enough, and we had far too few meetings for discussing findings.

"I hope others were more enthusiastic about this program than I was and that you have a successful evaluation of this."

VI. KARLE PERRY:

"I began the instruction with the ten selected students by informing them of goals we wanted to accomplish. We placed a table at the back of the classroom, which was designated as the 'working area.' At this table we had a record player, number games, number lines and practice cards for the four basic number facts. Supplementary texts were kept in the individual's desk.

"We set up a time period of thirty minutes each day. The first ten minutes was devoted to information as to what we would do on that particular day. The remaining twenty minutes was used for student activities.

"I attempted to make sure that these students felt secure working at this table. The rest of the class was not permitted to upset the work these students were doing.

"When several students needed more explanation on given problems, I used the board next to the table.

"Techniques: After working with the students for several weeks, I discovered they preferred the puzzles and number games as compared to the workbook - type text. The games and materials at the table proved their value. In general, I initiated a new game to the students by playing the game myself with the students. Some students preferred to keep score rather than play the game. Their addition and subtraction on the board created a learning situation in itself.

"We spent considerable time on the basic skills. Place value on the number line was emphasized. We kept reviewing the charts when needed. Students made their own charts.

"After an understanding of addition, subtraction, etc., I encouraged the pupils to use the understanding in practice examples and in problems relating to life situations. Practice was provided in using the particular step as a process which had proved troublesome for him.

"I often used texts from earlier grades to strengthen skills.

"How Worthwhile: I believe the program was worthwhile to the selected students because for the first time, these students got more attention from the teacher.

"Toward the end of the year, I could notice most of the students improved in their understanding of arithmetic. Calculating in addition, subtraction, etc., was done at a much faster rate than earlier in the year. In fact, I was able to place two students with a regular higher group. It worked to the best for the students involved.

"The students appreciated some of the self-teaching procedures used. They gained a feeling of self-confidence. They realized the worth of maintaining skill and accuracy by means of review, relearning when necessary, and practice. They improved their recognition of the necessity for accuracy and precision in exact arithmetical calculations.

"I sincerely believe the whole key to teaching these remedial students arithmetic is the presence of a teacher there to help them. The students I had looked forward to this period and were sincerely interested. They achieved."

PROJECT PRACTICUM

During the planning stages of this project it was decided that one first grade class and one second grade class in two separate school districts would be sufficient for inclusion because the project was designed to aid children with mathematical deficiencies, and one cannot accurately state that such a deficiency exists at these levels.

Due to the mobility of the population in these two school districts between the pre-testing and post-testing dates, many of the experimental students were lost to the project from the first and second grade groups. Therefore, an equal number were dropped from the control groups to keep them of equal size. This resulted in small test groups on both of these grade levels.

The entire third grade had to be dropped because a change in class distribution removed all but three experimental students, and all of the control group, from classrooms participating in this program.

From the fourth grade to the eighth grade there were a sufficient number of classes chosen to participate so that classroom changes and shifts in population did not have any decided effect upon the project. Stress was placed upon upper grade levels, again because these are the levels where deficiencies in mathematical skills begin to show up clearly, and where remedial work should be emphasized.

The results of the program, as shown by testing and by teacher-observation and evaluation, seems to bear out the original assumption that activities did not necessarily remedy a deficiency with the low-scoring students in the primary grades. However, there were so few students involved on the first and second grade levels that no accurate analysis of results can be made.